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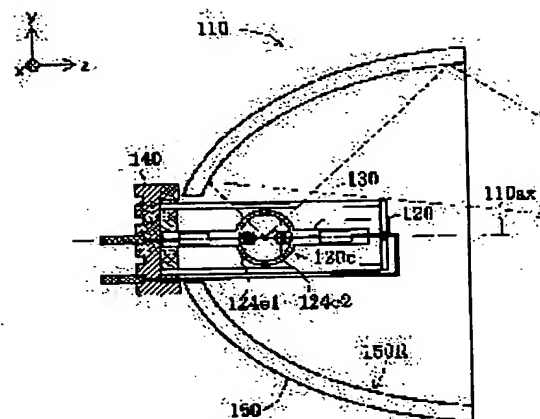
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LIGHT SOURCE DEVICE AND PROJECTOR USING THE SAME

Abstract:

PROBLEM TO BE SOLVED: To provide a technology capable of reducing deterioration of the optical output of a light source device by reducing devitrification of an arc tube mounted on the light source device.

SOLUTION: This light source device 110 comprises the arc tube 120 including a pair of electrodes inside thereof, and a translucent member 130 made of a translucent material having heat conductivity of approximately $W/(m.K)$ or more and mounted outside of the arc tube.



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AIMS

aim(s)]

aim 1] about [the arc tube which is light equipment and contains the electrode of a pair inside, and] -- the light equipment characterized by having the translucency member which was formed with the translucency ingredient which has the thermal conductivity more than 5.0W/(m-K), and has been arranged on the outside of said arc tube.

aim 2] It is light equipment said whose translucency ingredient it is light equipment according to claim 1, and is a lamp.

aim 3] It is light equipment which is the lamp which is light equipment according to claim 1, and said arc tube is a pair-electrode [of said pair], and is made to generate arc discharge.

aim 4] It is light equipment which is the lamp with which it is light equipment according to claim 1, and, as for said arc tube, the filament was formed in inter-electrode [of said pair].

aim 5] It is light equipment which has the tubed configuration where are light equipment according to claim 1, and the translucency member surrounds said some of arc tubes [at least].

aim 6] It is light equipment which is the outer tube to which it is light equipment according to claim 5, and said translucency member surrounds said whole arc tube.

aim 7] Light equipment which is light equipment according to claim 6, is further formed in the attaching part holding said arc tube and said outer tube, and said attaching part, and is equipped with the terminal for electric power supplies of which is electrically connected with the electrode of said pair.

aim 8] Light equipment with which it is light equipment according to claim 7, said attaching part is prepared in one section between two edges of said outer tube, and the plate of translucency is prepared in the other-end section.

aim 9] It is light equipment with which it is light equipment according to claim 1, and said translucency member does not touch said arc tube.

aim 10] Light equipment which is light equipment according to claim 1, and is equipped with the reflector which has a concave surface for reflecting further the light injected from said arc tube.

aim 11] Light equipment which is light equipment according to claim 10, and equips the effective area of said reflector with the plate of translucency further.

aim 12] The illumination-light study system which is the projector which indicates the image by projection and contains light equipment, It has the electro-optic device which modulates the light from said illumination-light study system according to image information, and the projection optical system which projects the modulation light obtained from said electro-optic device. Said light equipment The arc tube which contains the electrode of a pair inside, and the translucency member which was formed with the translucency ingredient which has the thermal conductivity of about 5.0 W / (m-K) more than, and has been arranged on the outside of said arc tube, The projector characterized by having a reflector which has a concave surface for reflecting the light injected from said arc tube.

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TAILED DESCRIPTION

tailed Description of the Invention]

01]

ld of the Invention] This invention relates to the projector which indicates the image by projection using light
ipment and this.

02]

scription of the Prior Art] In a projector, an image is displayed by modulating the light injected from the
mination-light study system according to image information (picture signal) with a liquid crystal light valve etc., and
jecting the modulated light on a screen.

03] The illumination-light study system contains light equipment. Light equipment is usually equipped with the arc
e which contains the electrode of a pair inside, and the reflector which reflects the light injected from an arc tube.

04]

blem(s) to be Solved by the Invention] By the way, in conventional light equipment, when the condensed mercury
perature of an arc tube became high too much, the arc tube became cloudy, and there was a problem that the optical
put of light equipment will deteriorate. This originates in devitrification of an arc tube. Here, devitrification is the
nomenon in which the glass which forms the tube wall of an arc tube recrystallizes.

05] This invention is made in order to solve the above-mentioned technical problem in the conventional technique,
it aims at offering the technique in which degradation of the optical output of light equipment can be reduced by
ucing devitrification of the arc tube with which light equipment was equipped.

06]

ie means for solving a technical problem, and its operation and effectiveness] about [the arc tube which the 1st
ipment of this invention is light equipment, and contains the electrode of a pair inside in order to solve a part of
ve-mentioned technical problem / at least /, and] -- it is formed with the translucency ingredient which has the
rmal conductivity more than 5.0W/(m-K), and is characterized by having the translucency member arranged on the
side of said arc tube.

07] In the light equipment of this invention, since the comparatively high translucency member of thermal
ductivity is arranged on the outside of an arc tube, the rise of the condensed mercury temperature by generation of
t of an arc tube can be reduced. Therefore, it becomes possible to be able to reduce devitrification of an arc tube and
reduce degradation of the optical output of light equipment.

08] As for said translucency ingredient, in above equipment, it is desirable that it is sapphire.

09] Thermal conductivity of sapphire is comparatively high. Therefore, if a translucency member is formed with
phire, the rise of the condensed mercury temperature of an arc tube can be reduced efficiently.

10] In above equipment, said arc tube may be inter-electrode [of said pair], may be a lamp made to generate arc
charge, and may be the lamp with which the filament was formed in inter-electrode [of said pair].

11] As for said translucency member, in above equipment, it is desirable to have the tubed configuration surrounding
d some of arc tubes [at least].

12] For example, a translucency member may be an outer tube surrounding said whole arc tube.

13] Thus, when arranging the translucency member which has a tubed configuration on the outside of an arc tube,
ile being able to reduce the temperature rise of the tube wall of an arc tube, it becomes possible to make mostly into
nogeneity condensed mercury temperature of the part surrounded by the translucency member.

14] Furthermore, in above equipment, it was prepared in the attaching part holding said arc tube and said outer tube,
l said attaching part, and you may have the terminal for electric power supplies of a pair electrically connected with
electrode of said pair.

- 15] If it carries out like this, the light equipment which consists of an arc tube, an outer tube, and an attaching part be unified.
- 16] In above equipment, said attaching part is prepared in one edge between two edges of said outer tube, and the edge of translucency may be prepared in the other-end section.
- 17] Moreover, as for said translucency member, in above equipment, it is desirable that it is not in contact with said arc tube.
- 18] Also when the condensed mercury temperature of an arc tube is too low, the optical output of light equipment may deteriorate. Therefore, if a translucency member is arranged in the condition of not being in contact with an arc tube, it will become comparatively easy to maintain the condensed mercury temperature of an arc tube in a determined temperature requirement.
- 19] You may make it have the reflector which has a concave surface for reflecting the light injected from said arc tube in above equipment.
- 20] If it carries out like this, the light injected from the arc tube can be injected in the predetermined direction.
- 21] Furthermore, you may make it equip the effective area of said reflector with the plate of translucency in above equipment.
- 22] The illumination-light study system which the 2nd equipment of this invention is a projector which indicates the image by projection, and contains light equipment, It has the electro-optic device which modulates the light from said illumination-light study system according to image information, and the projection optical system which projects the modulated light obtained with said electro-optic device. Said light equipment about [the arc tube which contains the electrode of a pair inside, and] -- it is formed with the translucency ingredient which has the thermal conductivity more than $5.0\text{W}/(\text{m}\cdot\text{K})$, and is characterized by having the translucency member arranged on the outside of said arc tube, and reflector which has a concave surface for reflecting the light injected from said arc tube.
- 23] In the projector of this invention, the light equipment which is the 1st equipment of this invention is used. Therefore, while becoming possible to be able to reduce devitrification of an arc tube, consequently to reduce degradation of the optical output of light equipment, it becomes possible to reduce degradation of the brightness of an image in which it is indicated by projection by the projector.
- 24] [Embodiment of the Invention] A. light equipment: -- A-1. 1st example: -- drawing 1 is the explanatory view showing light equipment 110 as the 1st example which applied this invention. Drawing 1 shows the outline sectional view when cutting light equipment 110 through light source optical-axis 110ax at yz flat surface parallel to light source optical-axis 110ax. Here, the medial axis of the light injected from light equipment 110 is meant in light source optical-axis 110ax.
- 25] Light equipment 110 is equipped with the arc tube 120, the outer tube 130 prepared in the outside of an arc tube 120, the attaching part 140 holding an arc tube 120 and an outer tube 130, and the reflector 150.
- 26] The reflector 150 has concave surface 150R of an ellipsoid-of-revolution configuration symmetrical with a shaft of light source optical-axis 110ax. The reflector 150 is formed with the hard glass which is excellent in thermal resistance, and the reflective film is formed in concave surface 150R. In addition, as reflective film, metal membranes, such as dielectric multilayers, aluminum film, and a silver film, can be used. The emission center of an arc tube 120 is arranged near the 1st focus of an ellipsoid of revolution, and the light injected from the arc tube 120 tends toward the 1st focus of an ellipsoid of revolution, after penetrating an outer tube 130 and being reflected by the reflector 150.
- 27] In addition, the light which tends toward the 2nd focus of an ellipsoid of revolution in applying this light equipment 110 to the projector mentioned later -- light source optical-axis 110ax -- abbreviation -- the parallel-ized lens changing into an parallel light is used.
- 28] Drawing 2 is the explanatory view expanding and showing the arc tube 120, the outer tube 130, and attaching part 140 of drawing 1.
- 29] An arc tube 120 is a high-pressure mercury lamp. an arc tube 120 -- the central part -- abbreviation -- it has a central light-emitting part 120c, and halogen gas is enclosed with the interior of light-emitting part 120c. The tube wall of an arc tube 120 is formed with the quartz which is excellent in thermal resistance and pressure resistance.
- 30] Inside the arc tube 120, after the electrode 124e1, 124e2 of a pair has left only fixed distance, it is arranged. As each electrode 124e1, 124e2, the coil made from a tungsten is prepared at the tip of the electrode arbor made from a tungsten. The electrode 124e1, 124e2 of a pair is connected with 124n 1, 124 n2 of lead wire made from nickel through molybdenum Tomari 124m1, 124m2, respectively. And 124n 1, 124 n2 of each lead wire is pulled out by the exterior of arc tube 120, and is connected with 2 for 124s 1, 124s the terminal for electric power supplies prepared in the attaching part 140. That is, the electrode 124e1, 124e2 of a pair is electrically connected with 2 124s 1, 124s of terminals

electric power supplies of a pair. And if a predetermined electrical potential difference is impressed between electrodes 124e1, 124e2 through 2 for 124s 1, 124s the terminal for electric power supplies, arc discharge will occur in r-electrode. Thereby, the light of the abbreviation radial centering on near the core of light-emitting part 120c is cted.

31] In addition, while arc discharge has occurred between the electrodes 124e1, 124e2 of a pair, the halogen regenerative cycle is advancing inside an arc tube 120. That is, the tungsten which forms an electrode 124e1, 124e2 evaporates within an arc tube 120. The tungsten which evaporated reacts in near the tube wall of an arc tube 120 with halogen gas enclosed in tubing, and a halogenation tungsten is generated. If the generated halogenation tungsten reaches an electrode 124e1, 124e2, it will be disassembled into halogen gas and a tungsten by concentration diffusion, the convection current, etc. The disassembled tungsten deposits on the front face of an electrode 124e1, 124e2. On the other hand, the decomposed halogen gas reacts again the tungsten and near a tube wall, and the above-mentioned halogenation tungsten is generated again. [which evaporated] When such a halogen regenerative cycle advances, an arc tube 120 can inject light continuously.

32] An outer tube 130 is the translucency member prepared near the outside of an arc tube 120, and has the approximately cylindrical configuration surrounding the whole arc tube 120. In addition, the outer tube 130 does not have an arc tube 120. The attaching part 140 is formed in one edge between two edges of an outer tube 130, and the plate 132 of the translucency of an approximate circle configuration is formed in the other-end section. Thus, since a fragment can prevent dispersing in the exterior of an outer tube 130 when an arc tube 120 explodes by forming an attaching part 140 and the plate 132 of translucency in the edge of an outer tube 130, and wrapping in an arc tube 120, there is an advantage that a fragment is easily recoverable. In addition, the stoma is prepared in the center of the plate 132 of translucency, and 2 is pulled out the 124n of the 2nd lead wire through the stoma.

33] The attaching part 140 has the approximate circle column-like appearance configuration, and is formed by the insulating material. The crevice 142 of an approximate circle form is formed in one attaching part 140 side. The arc tube 120 and the outer tube 130 are being fixed in the crevice 142. It is the adhesives 144 which are excellent in the thermal resistance and the insulation of cement etc., and, specifically, is fixed to the attaching part 140. Moreover, while 2 is prepared for 124s 1, 124s the terminal for electric power supplies of a pair, the concave heights 146 are formed in the other side side of an attaching part 140.

34] In this example, the arc tube 120, the outer tube 130, and the attaching part 140 are unified by the attaching part 140 holding an arc tube 120 and an outer tube 130 so that it may illustrate. If it carries out like this, when an arc tube 120 breaks down in light equipment 110, there is an advantage that the arc tube unit which consists of an arc tube 120, outer tube 130, and an attaching part 140 is easily exchangeable.

35] By the way, if the condensed mercury temperature of an arc tube becomes high too much as mentioned above, an arc tube may devitrify and the optical output of light equipment may deteriorate. Here, devitrification is the phenomenon in which the tube wall (this example quartz) of an arc tube recrystallizes. When using the light equipment 110 of drawing 1 and the electrode 124e1, 124e2 of a pair has been horizontally arranged to the ground, it is easy to generate this phenomenon in the tube wall of the upper part of light-emitting part 120c. This is for heat to concentrate the tube wall of the upper part of light-emitting part 120c. the condensed mercury temperature of the upper part -- the condensed mercury temperature of a lower part -- for example, about 100K- about 200 -- K -- it may become high

36] In this example, the outer tube 130 prepared in the outside of an arc tube 120 is formed with the comparatively high translucency ingredient of thermal conductivity. as the translucency ingredient which forms an outer tube 130 -- heat -- the ingredient which has the thermal conductivity more than 5.0W/(m-K) -- desirable -- about -- the ingredient which has the thermal conductivity more than 10W/(m-K) is desirable. As a translucency ingredient which has the thermal conductivity of about 5.0W / (m-K) more than, Xtal (single crystal of SiO₂) and sapphire can be used, for example. this example -- as a translucency ingredient -- about -- the sapphire which has the thermal conductivity of 10W/(m-K) is used. In addition, since Young's modulus is comparatively high, sapphire also has the advantage that it can prevent that an outer tube 130 explodes with the burst of an arc tube 120.

37] Thus, if the outer tube 130 formed with the comparatively high translucency ingredient of thermal conductivity is formed in the outside of an arc tube 120, since the temperature rise of the tube wall of an arc tube 120 can be reduced efficiently, it becomes possible to reduce devitrification of the tube wall of an arc tube 120.

38] In addition, the plate 132 of the translucency prepared in the edge of an outer tube 130 as well as an outer tube 130 is formed with sapphire.

39] If the condensed mercury temperature of an arc tube becomes high too much, as mentioned above, an arc tube 120 devitrify, the optical output of light equipment will deteriorate, but conversely, even if the condensed mercury temperature of an arc tube becomes low too much, an arc tube carries out melanism and the optical output of light

ipment deteriorates. Here, melanism is the phenomenon in which the halogenation tungsten generated in the above-mentioned halogen regenerative cycle adheres to the tube wall of an arc tube. When using the light equipment 110 of drawing 1 and the electrode 124e1, 124e2 of a pair has been horizontally arranged to the ground, it is easy to generate phenomenon in the tube wall of the lower part of light-emitting part 120c. This is for the heat of the tube wall of the lower part of light-emitting part 120c to move to the tube wall of the upper part, as the above-mentioned explanation was.

40] For this reason, in this example, the outer tube 130 which has a tubed configuration surrounding the whole arc tube 120 is arranged on the outside of an arc tube 120. If the translucency member which has such a tubed configuration is arranged on the outside of an arc tube, while being able to reduce the temperature rise of the tube wall of the upper part of light-emitting part 120c of an arc tube 120, condensed mercury temperature of the upper part and the lower part of the arc tube were surrounded by the outer tube 130 can be mostly made into homogeneity. And in this example, since the outer tube 130 is arranged in the condition of not contacting an arc tube 120, as compared with the case where it is arranged in the condition of having contacted, it cannot elapse and it can keep easy the condensed mercury temperature in an arc tube 120 in the predetermined temperature requirement [being high] which is not too low. Thus, it becomes possible by setting up the condensed mercury temperature of an arc tube in a predetermined temperature requirement to coincide and reduce devitrification and melanism of an arc tube.

41] Moreover, at this example, the attaching part 140 holding an arc tube 120 and an outer tube 130 is formed by the aluminum nitride (AlN) which is the comparatively high insulating material of thermal conductivity. Moreover, the cavity heights 146 formed in the attaching part 140 function as a cooling fin. If it does in this way, the heat of an arc tube 120 can be emitted outside through an outer tube 130 or an attaching part 140. Therefore, it is possible to be able to reduce further the temperature rise of the tube wall of an arc tube 120, consequently to reduce devitrification of the tube wall of an arc tube 120 further. In addition, it is desirable to use the comparatively high ingredient of thermal conductivity like an attaching part 140 also as adhesives 144 which fix an arc tube 120, an outer tube 130, and an attaching part 140.

42] As explained above, the light equipment 110 of this example is equipped with the arc tube 120 which contains electrode 124e1, 124e2 of a pair inside, and the outer tube 130 which was formed with the sapphire which has the thermal conductivity of about $5.0 \text{ W} / (\text{m} \cdot \text{K})$ more than, and has been arranged on the outside of an arc tube. If such light equipment 110 is used, the rise of the condensed mercury temperature by generation of heat of an arc tube can be reduced. Therefore, while being able to reduce devitrification of an arc tube, it becomes possible to reduce degradation of the optical output of light equipment.

43] In addition, the light equipment 110 shown in drawing 1 can omit a reflector, although it has the reflector 150.

44] A-2: The 2nd example : drawing 3 is the explanatory view showing light equipment 110A as the 2nd example which applied this invention. Although this light equipment 110A is almost the same as the light equipment 110 shown in drawing 1, drawing 2 of the 1st example, the plate 132 of the translucency prepared in the edge of an outer tube 130 is omitted, it replaces with this, and the plate 152 of translucency is formed in the effective area of a reflector 150.

45] Thus, since a fragment can prevent dispersing in the exterior of a reflector 150 when an arc tube 120 explodes and if it forms the plate 152 of translucency in the effective area of a reflector 150, there is an advantage that a fragment is easily recoverable.

46] A-3. The 3rd example : drawing 4 is the explanatory view showing light equipment 110B as the 3rd example which applied this invention. Although this light equipment 110B is almost the same as light equipment 110A (drawing 3 of the 2nd example, the attaching part 140 is omitted. And in light equipment 110B of this example, an arc tube 120, outer tube 130, and reflector 150' are unified.

47] That is, in light equipment 110B of this example, reflector 150' has the approximately cylindrical neck section 154 at the pars basilaris ossis occipitalis. An arc tube 120 and an outer tube 130 are inserted inside the neck section 154, and are being fixed with the adhesives 156 which are excellent in the thermal resistance and the insulation of cement.

48] Furthermore, 2 is omitted for 124s 1, 124s the terminal for electric power supplies of a pair with the abbreviation 124s. The attaching part 140 of drawing 3. And 1 is pulled out outside through adhesives 156 the 124n of the 1st lead wire, and 2 is pulled out outside through the stoma prepared in reflector 150' the 124n of the 2nd lead wire.

49] Thus, even if it omits an attaching part 140, it is possible to constitute light equipment 110B.

50] A-4. The 4th example : drawing 5 is the explanatory view showing light equipment 110C as the 4th example which applied this invention. Although this light equipment 110C is almost the same as light equipment 110B (drawing 4 of the 3rd example, the configuration of the translucency member arranged on the outside of an arc tube 120 is changed.

51] That is, in this example, translucency member 130C which has a tubed configuration surrounding some arc tubes (specifically light-emitting part 120c) is used. And translucency member 130C is being fixed to the arc tube 120. Translucency member 130C is the location distant from light-emitting part 120c, and, specifically, is being fixed to the tube 120 by Adhesives AD. In addition, as adhesives AD, what is excellent in thermal resistance and translucency is desirable.

52] A-5. The 5th example : drawing 6 is the explanatory view showing light equipment 110D as the 5th example which applied this invention. Although this light equipment 110D is almost the same as light equipment 110B (drawing 3 of the 3rd example, the configuration of the translucency member arranged on the outside of an arc tube 120 is changed.

53] That is, in this example, translucency plate 130D of an abbreviation rectangle is arranged on the outside of an arc tube 120. In addition, in light equipment 110D of drawing 6 , since it assumes that the electrode 124e1, 124e2 of a pair is horizontally arranged to the ground, translucency plate 130D is arranged only at the arc tube 120 bottom. Even if such, temperature rise of the tube wall of the upper part of light-emitting part 120c of an arc tube 120 can be reduced, consequently devitrification of the tube wall of an arc tube 120 can be reduced.

54] In addition, translucency plate 130D is the upper part of an arc tube 120, and is being fixed to reflector 150' by adhesives AD.

55] A-6. The 6th example : drawing 7 is the explanatory view showing light equipment 110E as the 6th example which applied this invention. Although this light equipment 110E is almost the same as light equipment 110B (drawing 3 of the 3rd example, the translucency member arranged on the outside of an arc tube 120 is arranged in the condition of contacting an arc tube 120.

56] Thus, when an arc tube 120 and translucency member 130E contact, the temperature rise of the tube wall of an arc tube 120 can be reduced efficiently. However, if condensed mercury temperature becomes low too much, the tube wall of an arc tube 120 will carry out melanism as mentioned above. So, in this example, the die length of translucency member 130E which has a tubed configuration is made small. Since the condensed mercury temperature of an arc tube 120 can be maintained in a predetermined temperature requirement even if such, the temperature rise of the tube wall of an arc tube 120 can be reduced, consequently devitrification of the tube wall of an arc tube 120 can be reduced.

57] In addition, translucency member 130E is being fixed to light-emitting part 120c of an arc tube 120 by adhesives AD on light-emitting part 120c of an arc tube 120. Since Adhesives AD have adhered to light-emitting part 120c so that it may illustrate, it is desirable to use what is excellent in thermal resistance as adhesives AD.

58] about [the arc tube 120 with which the light equipment 110A-110E of the 2nd thru/or the 6th example as well as light equipment 110 of the 1st example contains the electrode 124e1, 124e2 of a pair inside as explained above, and] it was formed with the sapphire which has the thermal conductivity more than $5.0\text{W}/(\text{m}\cdot\text{K})$, and has the translucency members 130, 130C, 130D, and 130E arranged on the outside of an arc tube. Therefore, while being able to reduce devitrification of an arc tube, it is possible to reduce degradation of the optical output of light equipment.

59] B. Projector : drawing 8 is the outline block diagram showing an example of the projector which applied this invention. The projector 1000 is equipped with the illumination-light study system 100, the colored light separation optical system 200, the relay optical system 220, the liquid crystal light valves 300R, 300G, and 300B of three sheets, cross dichroic prism 320, and the projection optical system 340.

60] The illumination-light study system 100 is equipped with polarization generating optical system, and injects one of linearly polarized light to which the polarization direction was equal. The light injected from the illumination-light study system 100 is divided into the colored light of three colors of red (R), green (G), and blue (B) in colored light separation optical system 200. Each separated colored light is modulated corresponding to image information in the liquid crystal light valves 300R, 300G, and 300B. Here, the liquid crystal light valves 300R, 300G, and 300B are equipped with the liquid crystal panel equivalent to the electro-optic device in this invention, and the polarizing plate arranged at the optical plane-of-incidence and irradiation labor attendant side. The modulation light is modulated according to image information in the liquid crystal light valves 300R, 300G, and 300B is compounded with cross dichroic prism 320, and is projected by the projection optical system 340 on Screen SC. By this, an image will be displayed on Screen SC. In addition, since the configuration and function of each part of a projector as shown in drawing 8 are explained in full detail by JP,10-325954,A indicated by the applicant for this patent, for example, detailed explanation is omitted in this specification.

61] In this projector 1000, the light equipment 110 of drawing 1 is used as light equipment of the illumination-light study system 100. In addition, as mentioned above, light equipment 110 is equipped with the reflector 150 which has a concave surface 150R of an ellipsoid-of-revolution configuration, and injects the light which tends toward the 2nd focus of an ellipsoid of revolution. for this reason, the light which tends toward the 2nd focus of an ellipsoid of revolution at

irradiation labor attendant side of this light equipment 110 -- light source optical-axis 110ax -- abbreviation -- it has parallel-ized lens 180 for changing into an parallel light.

62] In this light equipment 110, since the comparatively high translucency member (outer tube) 130 of thermal ductivity is arranged on the outside of an arc tube 120, the rise of the condensed mercury temperature by generation heat of an arc tube can be reduced. Therefore, it becomes possible to be able to reduce devitrification of an arc tube to reduce degradation of the optical output of light equipment.

63] In addition, the projector 1000 is equipped with the cooling fan 400 for cooling light equipment 110. Therefore, it becomes possible to be able to reduce further the rise of the condensed mercury temperature of an arc tube 120, subsequently to reduce degradation of the optical output of light equipment 110 further.

64] If such light equipment 110 is applied to a projector 1000, it will become possible to reduce degradation of the brightness of an image in which it is indicated by projection by the projector.

65] In addition, this invention can be carried out in various modes in the range which is not restricted to an above-mentioned example or an above-mentioned operation gestalt, and does not deviate from the summary, for example, the following deformation is also possible for it.

66] (1) Although 2 is prepared in one edge of the two edges of an outer tube 130 for 124s 1, 124s the attaching part and the terminal for electric power supplies of a pair, when a reflector 150 is omitted and it constitutes light equipment from light equipment 110, 110A of the 1st and 2nd examples, you may make it prepare an attaching part and terminal for electric power supplies in the both ends of an outer tube, respectively.

67] (2) Although the tube wall of an arc tube 120 is formed with the quartz, you may make it use the arc tube in which the tube wall was formed with other glass in the above-mentioned example.

68] (3) In the above-mentioned example, as an arc tube 120, although the high-pressure mercury lamp is used, as an arc tube, the lamp (electric-discharge lamp) made to generate arc discharge can be used for inter-electrode [of a pair]. Moreover, as an arc tube, the lamp with which the filament was formed in inter-electrode [of pairs such as a halogen lamp,] may be used.

69] (4) In the light equipment 110, 110A and 110B of the 1st thru/or the 3rd example, the translucency member (outer tube) 130 which has a tubed configuration surrounding the whole arc tube 120 is used. Moreover, in the light equipment 110C and 110E of the 4th and 6th examples, the translucency members 130C and 130E which have a tubed configuration surrounding some arc tubes are used.

70] Thus, generally the translucency member should just have the tubed configuration surrounding some arc tubes at least].

71] Moreover, in light equipment 110D of the 5th example, translucency plate 130D arranged only at the arc tube bottom is used.

72] thus -- general -- about -- the translucency member formed with the translucency ingredient which has the thermal conductivity more than $5.0\text{W}/(\text{m}\cdot\text{K})$ should just be arranged on the outside of an arc tube.

73] (5) Although formed using hard glass, you may make it form a reflector 150 in the above-mentioned example using aluminum. If it carries out like this, light equipment and the projector using this can be lightweight-ized.

74] Moreover, although the reflector 150 has concave surface 150R of an ellipsoid-of-revolution configuration, you may make it have the concave surface of a paraboloid-of-revolution configuration in the above-mentioned example. In addition, in this case, since the light reflected by the reflector is injected almost in parallel with light source optical-axis 110ax, it can omit the parallel-ized lens 180 of a projector 1000.

75] Generally, light equipment should just be equipped with the reflector which has a concave surface for reflecting light injected from an arc tube. If it carries out like this, the light injected from the arc tube can be injected in the determined direction.

76] (6) Although the above-mentioned example explains the case where this invention is applied to the projector of a transparency mold to the example, this invention can be applied also to the projector of a reflective mold. Here, the "transparency mold" means that it is the type whose electro-optic device as a light modulation means penetrates light as a transparency mold liquid crystal panel, and means that a "reflective mold" is a type whose electro-optic device as a light modulation means reflects light like a reflective mold liquid crystal panel.

77] (7) Although the projector 1000 is equipped with the liquid crystal panel as an electro-optic device, it is replaced with this and you may make it equipped with micro mirror mold light modulation equipment in the above-mentioned example. As micro mirror mold light modulation equipment, DMD (digital micro mirror device) (trademark of TI, Inc.) may be used, for example. What is necessary is just to modulate the light from an illumination-light study system generally as an electro-optic device according to image information.

78] (8) Although the above-mentioned example explains the projector 1000 which displays a color picture to the

nple, also in the projector which displays a monochrome image, it is the same.

translation done.]

NOTICES *

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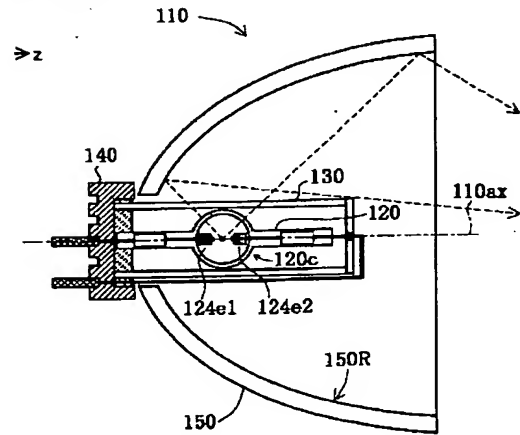
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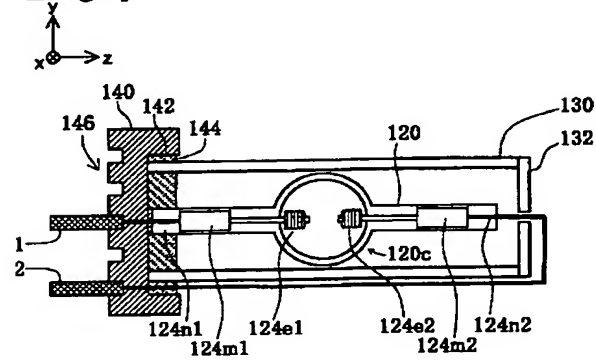
the drawings, any words are not translated.

AWINGS

awing 1]



awing 2]



awing 3]

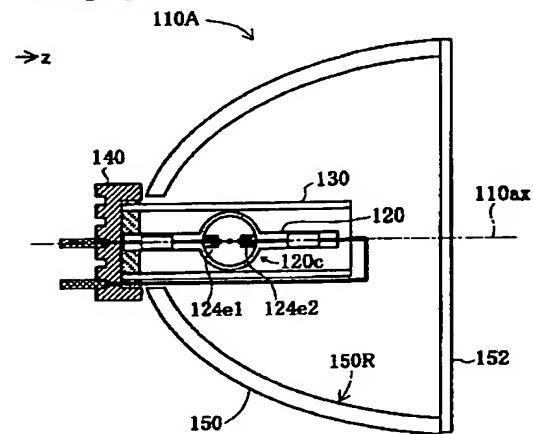


Figure 4]

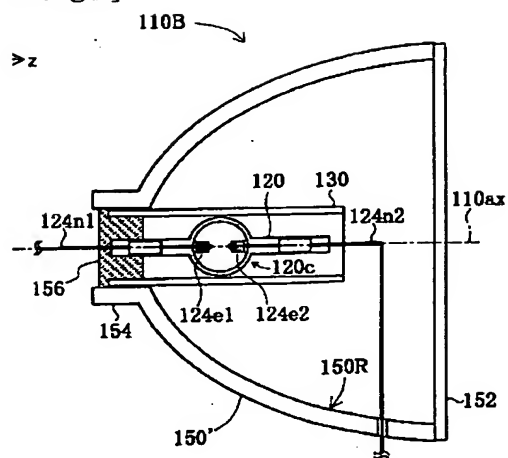


Figure 5]

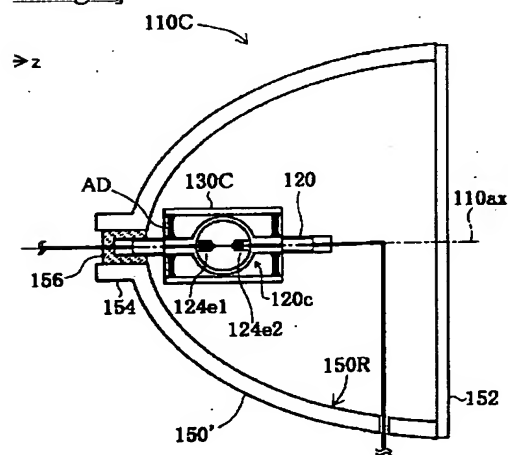


Figure 6]

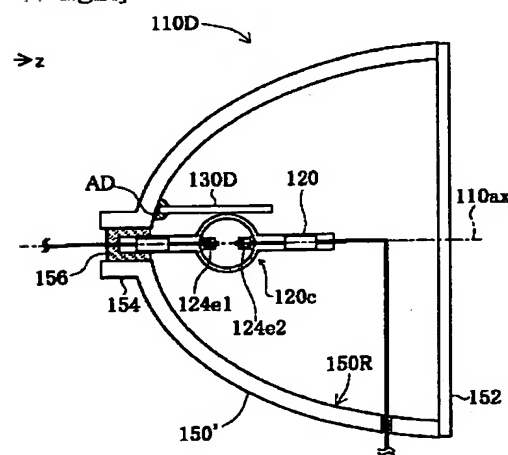
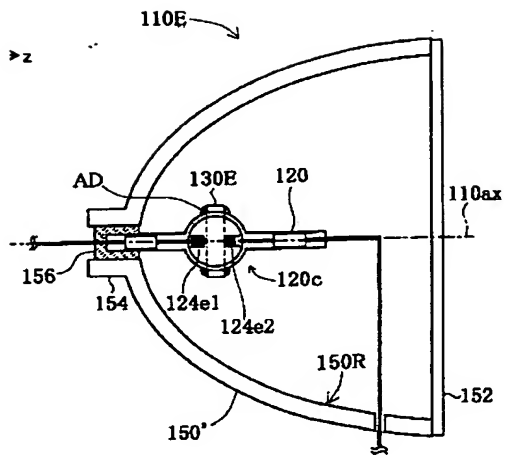
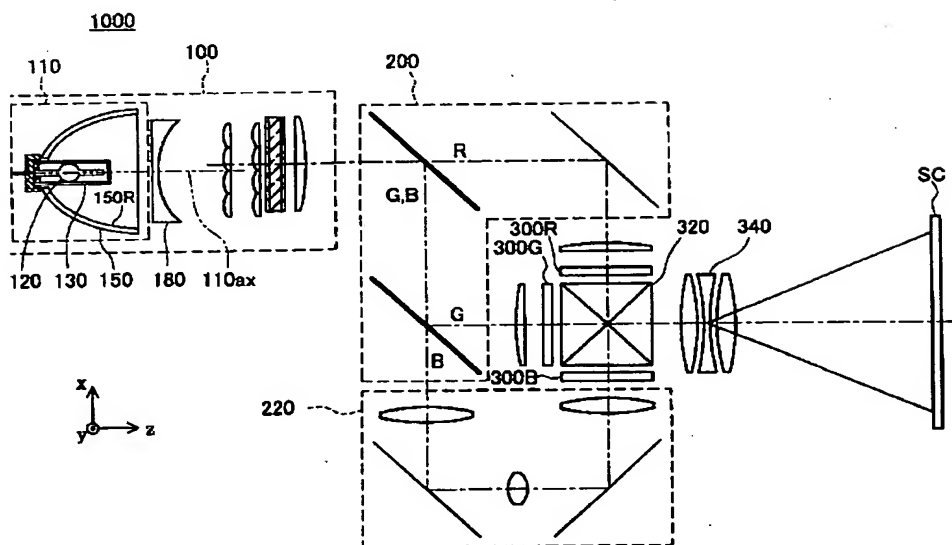


Figure 7]



awing 8]



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